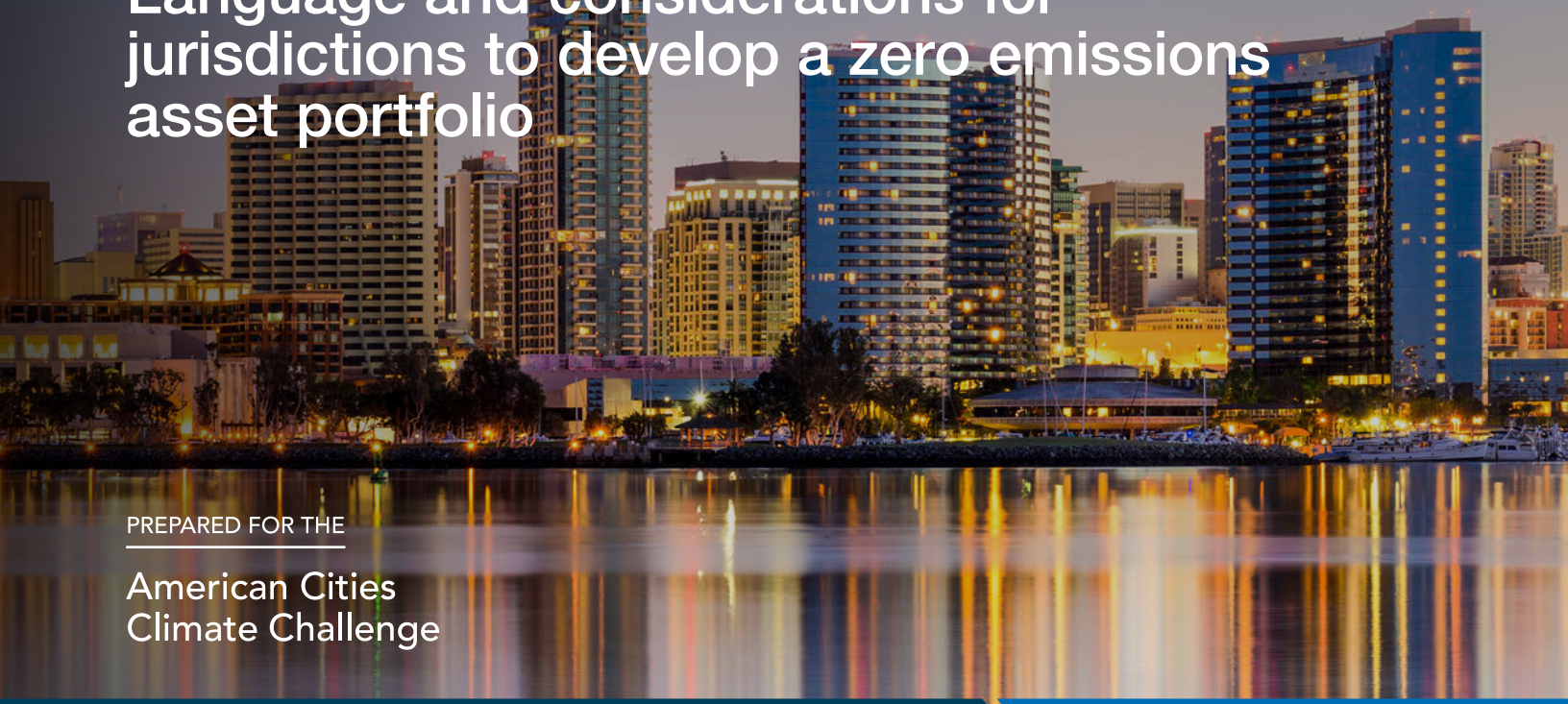
nbi new buildings institute

Model Government Zero Emissions Buildings Policy

Language and considerations for jurisdictions to develop a zero emissions asset portfolio



PREPARED FOR THE

American Cities Climate Challenge

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Codes for Climate™

San Diego, CA

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This model policy was developed with support from the Bloomberg Philanthropies' American Cities Climate Challenge. The Climate Challenge is an initiative that empowers 25 of the largest U.S. cities to implement near-term climate goals and become primary drivers of progress towards meeting America's pledge on climate. Recognizing that cities account for a significant portion of global carbon emissions—and that mayors have significant authority over cities' highest emitting sectors: transportation and buildings—the Climate Challenge aims to enhance the work already being done by mayors across the U.S. and to support cities in the fight against climate change. The following are primary authors and contributors from NBI and the Natural Resources Defense Council (NRDC):

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Table of Contents

Model Policy Language

Background

Building construction and operations account for 39% of global greenhouse gas (GHG) emissions, and a similar portion of U.S. emissions. Approximately 20% of the floorspace in the U.S. is owned by state and local governments, representing a significant opportunity to demonstrate what is possible, reduce emissions, and responsibly shepherd public dollars.[1] Cities and states across the U.S. have set bold, aggressive energy and climate goals, many targeted at building construction and operations. These governments recognize the need to make progress across both publicly and privately owned building stocks, and especially the need to lead by example with demonstration projects, pilot programs, and ambitious goals in their own facilities and operations.

To date, most of these policies and programs have focused on energy efficiency or zero energy goals, but with an evolving understanding of the broad climate impacts of the built environment, jurisdictions are now looking to account for the full carbon impact of their building stock and turning to goals and policies that achieve zero emissions.

Lead by Example programs can take many forms, and may include new construction and existing buildings policies, executive orders, procurement guidance and go beyond buildings to cover vehicles, employee commuting and travel, waste, water use, or other sectors and actions. **This model language is meant to help governments develop a zero emissions buildings policy for their owned assets, and should be considered part of a larger Lead by Example program.[2]**

The policy language included in this document is meant to be representative—in many cases, language, metrics, or thresholds will need to be customized to the government's circumstances. This model policy was developed through work with local governments. While this document reflects their perspectives, it should not be interpreted as their policy position—any errors or omissions are the authors' alone.

Approximately

20%

of the floorspace in the U.S. is owned by state and local governments, representing a significant opportunity to demonstrate what is possible, reduce emissions, and responsibly shepherd public dollars.[1]

1 Sources: International Energy Agency, US Energy Information Agency, and 2012 Commercial Buildings Energy Consumption Survey.

2 For additional information on government lead by example programs, visit ACEEE's policy database topic page: https://www.aceee.org/topic/government-lead-example

Zero Emissions Buildings Policy Goals

While the specific goals of individual governments will vary in their timing and scope, the goal of this policy is to reduce carbon and other greenhouse gas (GHG) emissions to achieve portfolio-wide zero emissions in government building operations by a target year.

This is done by prioritizing proven energy efficiency strategies, eliminating the use of non-emergency fossil fuel systems and appliances, and requiring the generation or procurement of renewable energy sources to offset emissions from building operations. In some cases, depending on the scope of the policy, this may also include the non-operational lifecycle emissions from building construction (embodied carbon) and decommissioning. The policy language included in this publication accounts for these strategies.

Using the Model Policy

1

The language in this document is structured to be used in policies:

Text that is not formatted as a call-out box should be interpreted as plug-in policy text.

Text that is formatted as a call-out box with light gray coloring is meant to provide context, considerations, or additional information for the user.

2

There are also **[CLEARLY-LABELED PLACEHOLDERS]** for jurisdictionally determined aspects of a policy, such as the building size threshold, target year, or agency responsible for enforcing the policy.

While this document is meant to provide a full zero emissions buildings policy as a component of a broader Lead by Example program, policy formatting, required fields and information, and language choices can vary widely by jurisdiction. As such, this language should be incorporated as is appropriate within the parameters of the local jurisdictions' requirements.

This document also includes additional resources that can be referenced and used in the development of a zero emissions buildings policy. Much of this language is based on work with local jurisdictions, it is always recommend to reference precedent policies in the development of new laws within a jurisdiction. With many jurisdictions newly considering zero emissions building policies, the precedent policies that this model language is based on are under active consideration at time of publication. NBI will publish future versions of this document with reference to final, publicly available policy language from specific jurisdictions.

3

Model policy language in this document includes provisions related to the full lifecycle of buildings, from construction to operation, to connections with the transportation infrastructure. For ease in clearly identifying provisions related to different components of the building lifecycle, we include the following icons throughout the document. When information is presented that is specific to energy efficiency (EE), electrification (ELEC), renewable energy (RE), embodied carbon (EC), or electric vehicles (EV) those sections are highlighted with these icons. Most of this language can be considered plug-and-play, meaning that jurisdictions can pull components of interest and relevance to their building stock as needed.

EE
energy efficiency

ELEC
electrification

RE
renewable energy

EC
embodied carbon

EV
electric vehicle

Portland, OR

Model Policy Language

Statement of Purpose

The purpose of this policy is to reduce *greenhouse gas (GHG)* emissions from buildings owned and operated by **[JURISDICTION]** and achieve portfolio-wide zero emissions in government building operations by **[TARGET YEAR]** to mitigate the impacts of climate change.

The structure of a policy will vary significantly from jurisdiction to jurisdiction, especially with respect to the background information required, the statement of purpose, and inclusion of references to precedent policies and programs. Governments should ensure that the policy structure and background language included up front aligns with local precedent and requirements.

Throughout this document, placeholders have been included for the target year of a policy, noted as **[TARGET YEAR].** The target year selected will be determined locally and should align with the jurisdiction's climate goals and strategies. Placeholders have also been included to insert the name of the jurisdiction, designated as **[JURISDICTION]** throughout.

Definitions

Governments should review current laws and policies within their jurisdiction to ensure that definitions in this policy align across existing programs and policies. Based on that review, some of these definitions may need to be revised or removed, and others may need to be added or cross referenced to ensure consistency within building-related policies and programs already in place.

a) *Design Target:* The annual energy use intensity calculated for a *proposed design.*

b) *Electric Vehicle (EV):* An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, electric motorcycles, and the like, primarily powered by an electric motor that draws current from a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current. Plug-in hybrid electric vehicles are electric vehicles having a second source of motive power. Off-road, self-propelled electric mobile equipment, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats and the like, are not considered electric vehicles.

c) *Electric Vehicle Capable Space:* An automotive parking space that is provided with some of the infrastructure necessary for the future installation of *electric vehicle supply equipment,* such as conduit, raceways, electrical capacity signage, or reserved physical space for such infrastructure.

d) *Electric Vehicle Ready Space:* An automotive parking space that is provided with an electrical circuit capable of supporting an installed *electric vehicle supply equipment.*

e) *Electric Vehicle Supply Equipment (EVSE):* The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the *electric vehicle* connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the *electric vehicle.*

f) *Embodied Carbon:* The total impact of all the *greenhouse gases* emitted by the supply chain of a construction material, including raw material extraction, transport to the manufacturing plant, the manufacturing process, the transport of finished goods to the construction site, construction site activities and material losses, materials use phase, repair, maintenance, and replacement, as well as end-of-life processing.

g) *Energy Retrofit:* Any construction, retrofit or renovation to an existing structure other than *a major renovation,* that alters or reconfigures the *thermal envelope* of a building or its *systems* and equipment.

h) *Energy Use Intensity (EUI):* Is the energy use of a building, regardless of fuel type, normalized by the building's size. It is reported as a value of thousand British thermal units (kBtu) per square foot per year.

i) *Environmental Product Declaration (EPD):* An independently verified and registered document that reports a product's environmental impact over its lifecycle.

j) *Global Warming Potential (GWP):* The equivalent amount of carbon dioxide associated with the warming effect of a given quantity of a *greenhouse gas* expressed as carbon dioxide-equivalent (CO_2e). Global warming potentials vary by the time horizon—this most typically used GWP is the 100-year metric.

k) *Greenhouse Gas (GHG) Emissions:* A measure used to determine and compare the emissions of various greenhouse gases based upon their *global warming potential.* The CO_2e for a gas is calculated by multiplying the weight of the gas by its associated *GWP.*

l) *Gross Floor Area:* The sum of the floor areas of the spaces within the building with no deductions for floor penetrations other than atria. It is measured from the exterior faces of exterior walls or from the centerline of walls separating buildings, but it excludes covered walkways, open roofed-over areas, porches and similar spaces, pipe trenches, exterior terraces or steps, roof overhangs, parking garages, surface parking, and similar features.

m) *Major renovation:* Any repair, alteration, addition, or improvement of a building or structure, where the work area exceeds 50% of the building's *gross floor area.*

n) *New construction:* Newly constructed building that has never been used or occupied for any purpose.

o) *On-site renewable energy system:* Photovoltaic, solar thermal, geothermal energy, and wind systems used to generate energy and located on any of the following:

   i) The building

   ii) The property upon which the building is located

   iii) A property that shares a boundary with and is under the same ownership or control as the property on which the building is located

   iv) A property that is under the same ownership or control as the property on which the building is located and is separated only by a public right-of-way from the property on which the building is located

p) *Proposed design:* A description of the proposed building, or portion thereof, used to estimate annual energy use and fossil fuel combustion, used as the basis for calculating the design target.

q) *Renewable Energy Certificate (REC):* A market-based instrument that represents and conveys the environmental attributes of one megawatt hour of renewable electricity generation. RECs can be sold separately from the underlaying physical electricity associated with the renewable energy resources; also known as "energy attribute" and "energy attribute certificate."

r) *Renewable energy power purchase agreement (PPA), financial:* A financial arrangement between a renewable electricity generator and a purchaser wherein the purchaser pays or guarantees a price to the generator for the project's renewable generation. Also known as a "financial power purchase agreement" and "virtual power purchase agreement."

s) *Renewable energy power purchase agreement (PPA), physical:* A contract for the purchase of renewable electricity from a specific renewable electricity generator to a purchaser of renewable electricity.

t) *Site Energy Use:* Energy consumed as measured or estimated at the building site boundary.

u) *Site Energy Use Intensity (Site EUI):* A measurement that normalizes a building's *site energy use* relative to its size. A building's site energy use intensity is calculated by dividing the total net energy consumed in one year by the gross floor area of the building, excluding the parking garage.

v) *System:* A combination of equipment and auxiliary devices by which energy is transformed so it performs a specific function, such as heating, ventilation and air conditioning, service water heating, or lighting.

w) *Thermal Envelope:* The basement walls, exterior walls, floors, ceilings, roofs and any other building element assemblies that enclose conditioned space or provide a boundary between conditioned space and exempt or unconditioned space.

x) *Type III Environmental Product Declaration (Type III EPD):* A product-specific *environmental product declaration* that conforms to International Organization for Standardization (ISO) standard 14025, and European Standard (EN) 15804 or ISO 21930. The Type III EPD includes the numeric global warming potential of the product and has at least a "cradle to gate" scope, covering product lifecycle from resource extraction to the factory.

Acronyms used throughout this document are summarized in the table below for ease of use and review of this guidance document.

Acronym	Definition
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
CARB	California Air Resources Board
CBECS	Commercial Buildings Energy Consumption Survey
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
DOE	U.S. Department of Energy
EN	European Standard
EPA	U.S. Environmental Protection Agency
EPD	Environmental Product Definition
EUI	Energy Use Intensity
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
F-Gas	Fluorinated gas
GHG	Greenhouse Gas
GSA	U.S. General Services Administration
GWP	Global Warming Potential
HVAC	Heating, Ventilation and Air Conditioning
ISO	International Organization for Standardization
kBtu	Thousand British Thermal Units
LCA	Life Cycle Assessment
NBI	New Buildings Institute
PPA	Power Purchasing Agreement
PDF	Portable Document Format
REC	Renewable Energy Certificate
RMP	CARB's Refrigerant Management Program
RTO	Regional Transmission Organization
SNAP	EPA's Significant New Alternatives Policy
U.S.	United States

Scope

The scope of the zero emissions buildings policy should be within the sphere of influence of the jurisdiction—including buildings owned and leased by the government. The scope of the policy should align with the government's climate goals, and ideally the government-owned or leased portfolio should be demonstrating what is possible—with more ambitious requirements than the private sector, and willingness to demonstrate innovative technologies and techniques to achieve zero emission buildings.

1) Commencing with the effective date of this policy, *new construction* and *major renovation* projects owned, occupied, or leased by **[JURSIDICTION],** larger than **[SIZE THRESHOLD]** shall implement the following strategies:

Throughout this document, placeholders have been included for the size threshold to determine which buildings a jurisdiction should consider including in their zero emissions buildings policy, noted as **[SIZE THRESHOLD]** in the text. This threshold will be determined by a jurisdiction's specific circumstances—including how many buildings of what size and type are within their asset portfolio and the resources available to dedicate to data collection, tracking and building improvements. It is important to strike a balance between covering a large portion of the overall square footage of the municipal portfolio, while avoiding very small buildings (like ticket booths, snack stands and restrooms) that would have a low emissions impact relative to the level of effort needed to include those buildings. Typical minimum size thresholds range from 5,000 to 25,000 square feet, depending on the jurisdiction.

a. Prioritize energy efficiency by achieving appropriate energy performance targets such as the *Site EUI* targets included in Table 1 and Table 2 of this policy.

Energy efficiency remains a key foundational tool in building design, construction and operation—the cheapest and most environmentally beneficial unit of energy is the one that is not required. It is important to prioritize energy efficiency measure first because designing and operating the building to require the least amount of energy possible means that additional measures—like renewable energy installation or procurement—are right-sized for the highest-performing version of that building.

b. Specify highly-efficient, electric-only sources for space conditioning, water heating, cooking, lighting, and all other non-emergency functions.

Heat pumps should be deployed where applicable for heating and air conditioning, domestic and service hot water, and clothes drying, while other end uses like cooking and lighting should be electrified. In climates or buildings that require a very low level of heating, electric resistance may be a more appropriate application for the end use than heat pumps—jurisdictions are encouraged to investigate the most appropriate electrification technologies for their climate and building end uses.

c. Generate or procure sufficient renewable energy resources to meet the building's operational energy needs, prioritizing on-site sources first and supplementing with off-site where the *Renewable Energy Certificates (RECs)* are retired.

d. Reduce the lifecycle impacts of *embodied carbon* associated with materials.

Addressing embodied carbon is a critical step to decarbonizing buildings—as buildings become more energy efficient, embodied carbon can account for nearly half of a building's total carbon footprint over its lifetime. Material manufacturing is carbon-intensive and uses large quantities of fossil fuels before construction materials ever reach a construction site. Construction materials alone are responsible for about 11% of all global carbon emissions.

2) All governmental agencies or departments shall develop a plan for the elimination of sources of fossil fuel combustion within their existing buildings by **[TARGET YEAR].**

It is important to develop a plan for the elimination of fossil fuel combustion in order to identify the issues, priorities, and sequences are optimal for eliminating fossil fuels from the jurisdiction's buildings portfolio. This allows the jurisdiction to understand which buildings are using fossil fuels, understand the capital improvement and equipment replacement cycles of these buildings, and optimize the order in which large systems are replaced and electrified throughout the jurisdiction's building portfolio.

3) All *new construction* and *major renovation* projects owned, occupied, or leased by the **[JURISDICTION],** larger than **[SIZE THRESHOLD]** shall annually report the following to **[ENFORCING AGENCY],** and **[ENFORCING AGENCY]** shall annually publicly disclose:

a. Annual energy use

b. Annual *GHG emissions*

c. *Embodied carbon* emissions

Throughout this document, placeholders have been included for the agency charged with implementing and enforcing this policy, noted as **[ENFORCING AGENCY]** in the text. It is important that these data be made publicly available, and be updated regularly, to demonstrate the progress of the jurisdiction toward achieving its stated goals, and to lead by example in demonstrating what is achievable.

4) To further reduce *GHG emissions* from buildings, *new construction* and *major renovation* projects should take steps to reduce the *embodied carbon* emissions associated with building materials and products, such as reusing existing facilities, structures, or materials; reducing and being efficient with selected materials, specifying low-carbon concrete mixes, identifying lower carbon materials, purchasing low carbon products, etc. The following strategies are included:

a. Align with state or federal low carbon material procurement policy for the purchase of low carbon building products

Jurisdictions are responsible for funding the construction and maintenance of both buildings and infrastructure, they are the largest purchasers of concrete, second only to residential construction.[3] The U.S. General Services Administration's (GSA) low carbon concrete and asphalt specs, Low Embodied Carbon Concrete Standards for all GSA Projects and Environmentally Preferable Asphalt Standards for all GSA Projects sets GWP limits and environmental requirements for all concrete and asphalt products used on GSA contract awards for both capital and small, regardless of funding source.[4,5]

b. Reuse existing facilities, structures, or materials; the project should reduce and be efficient with materials wherever possible

c. Adopt EPA's Significant New Alternatives Policy (SNAP) rule 20, account for *GHG emissions* from refrigerants and encourage the use of low-*Global Warming Potential (GWP)* refrigerants

Refrigerants have GWPs 2,000 times greater than that of carbon dioxide (CO_2) over a 100-year period and can be nearly 4,000 times greater than CO_2. Refrigerants and blends range from 0 to 12,500 GWP. Global refrigerant demand is expected to grow four-fold by 2050 because of increased adoption of highly efficient heat pumps and the increased demand for cooling, especially as global temperatures rise. If unregulated, this expansion in refrigerant use would lead to refrigerants making up a greater percentage of total GHG emissions.

Fluorinated gas (F-gas) refrigerants are responsible for 2% of total global GHG emissions. Many refrigerants have high GWP, so it is crucial that low GWP refrigerants are selected, leaks from equipment be repaired promptly, and refrigerants are collected during maintenance and when equipment is retired.

3 Portland Cement Association (PCA). US Cement Industry Annual Yearbook 2016. **http://www2.cement.org/econ/pdf/Yearbook2016_2sided.pdf**

4 U.S. General Services Administration. Low Embodied Carbon Concrete Standards for all GSA Projects. (March 2022). **https://www.gsa.gov/cdnstatic/Low%20embodied%20carbon%20concrete%20SOW%20language%203-29-22_0.pdf**

5 U.S. General Services Administration. Environmentally Preferable Asphalt Standards for all GSA Projects. (March 29, 2022). **https://www.gsa.gov/cdnstatic/Environmentally%20preferable%20asphalt%20SOW%20language%203-29-2022_0.pdf**

Implementation

New Construction and Major Retrofit Requirements

EE

1) All *new construction* projects larger than **[SIZE THRESHOLD]** shall use building energy modeling software capable of performing hourly simulations to demonstrate that the proposed design meets, or is lower than, the applicable *Site EUI* targets specified in Table 1. Building types not included in Table 1 shall exceed most recent published version of ASHRAE 90.1[6] by at least 20% following the Appendix G methodology.

TABLE 1: PROPOSED ZERO ENERGY SITE EUI TARGETS FOR NEW CONSTRUCTION PROJECTS[7]

Building Type	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
Primary School	26	25	26	25	27	23	21	27	24	24	28	25	24	29	26	30	39
Secondary School	29	29	26	27	26	25	22	24	26	26	25	29	23	24	24	25	35
Small Office	19	20	18	19	18	18	16	17	18	17	18	17	16	18	18	20	24
Medium Office	24	24	23	23	23	21	17	22	20	20	24	21	20	25	23	22	27
Public Assembly	27	28	27	27	28	26	24	28	26	26	30	28	27	31	29	34	40
Warehouse	5	8	6	8	7	7	7	9	8	8	11	9	9	11	10	15	16
Fire Station	29	30	29	29	30	28	25	30	28	28	33	30	29	33	31	26	43

When selecting target site EUIs for new construction, a jurisdiction should only include targets for climate zones that are within their geography. The full table is included in this section to provide reference for these building types in a nationally representative sample of buildings. There may also be additional building types within the scope of a jurisdiction's asset portfolio that are not included in these tables (for example, laboratories, libraries or museums), which may require additional analysis to determine the appropriate Site EUI targets or can fall under the "building types not included" language in items 1 or 2 of this section.

The percentage improvement included in item 1 includes reference to ASHRAE 90.1 Appendix G. As the language is written, there is no prescriptive option for compliance. Where a jurisdiction is interested in providing a prescriptive path, Chapter 7 of ASHRAE Standard 189.1 is recommended. This standard is developed specifically for high performance buildings and Chapter 7 includes prescriptive energy requirements that improve upon 90.1. Language for inclusion of this option may look like:

1) All new construction projects larger than **[SIZE THRESHOLD]** shall comply with one of the following:

   a. Use building energy modeling software capable of performing hourly simulations to

6 ASHRAE Standard 90.1: Energy Standard for Buildings Except Low-Rise Residential Buildings. **https://www.ashrae.org/technical-resources/bookstore/standard-90-1**

7 Carbonnier, Kevin. *Zero Energy Commercial Building Targets: Commercial Building Performance Targets for Designers and Policymakers* (September 2019). New Buildings Institute. **https://newbuildings.org/resource/zero-energy-commercial-building-targets/**. Building types included in this table were only those from the original document that were likely to be government-owned.

demonstrate that the proposed design meets, or is lower than, the applicable Site EUI targets specified in Table 1.

b. Building types not included in Table 1 shall exceed most recent published version of ASHRAE 90.1 by at least 20% following the Appendix G methodology.

c. Comply with the mandatory and prescriptive measures of the most recent published version of ASHRAE 189.1 Chapter 7.

This language would allow the prescriptive option to be selected on a project-by-project basis, and could be further restricted for certain building types or on specific approval of the department.

EE

2) All *major renovation* projects larger than **[SIZE THRESHOLD]** shall use building energy modeling software capable of performing hourly simulations to demonstrate that the proposed design meets, or is lower than, the applicable ***Site EUI*** targets specified in Table 2, or exceeds the most recent published version of ASHRAE 90.1 by 15% or more following the Appendix G methodology. All other building types not included in Table 2 shall exceed the applicable version of ASHRAE 90.1 by at least 15%.

TABLE 2: PROPOSED SITE EUI TARGETS FOR MAJOR RENOVATION PROJECTS

Building Type	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
Primary School	30	29	30	29	31	27	25	31	28	28	32	29	28	33	30	34	43
Secondary School	42	42	39	40	39	38	35	37	39	39	38	42	36	37	37	38	48
Small Office	35	36	34	35	34	34	32	33	34	33	34	33	32	34	34	36	40
Medium Office	36	36	35	35	35	33	29	34	32	32	36	33	32	37	35	34	39
Public Assembly	29	30	29	29	30	28	26	30	28	28	32	30	29	33	31	36	42
Warehouse	7	10	8	10	9	9	9	11	10	10	13	11	11	13	12	17	18
Fire Station	31	32	31	31	32	30	27	32	30	30	35	32	31	35	33	28	45

The EUI targets in Table 2 were developed using a variety of source data. This includes an improvement to the EUI's presented in ASHRAE Standard 100, which uses a statistical analysis to identify improvements beyond the existing buildings stock (based on data from the Commercial Buildings Energy Consumption Survey, or CBECS), as then refined based on several engineering studies and analysis looking at the impact of several combinations of retrofit packages. For jurisdictions with benchmarking data, existing building targets can be further refined to reflect major retrofit capabilities for energy use reduction.

ELEC

3) All *new construction* and *major renovation* projects shall be designed and operated without using fossil fuel systems and appliances for meeting regulated loads including space conditioning, water heating, cooking, lighting, and all other non-emergency functions.

Requiring that all new construction and major renovation projects be all-electric is critical in helping municipalities meet their climate goals and ensures that the buildings that they own and manage are future-proofed from having to retrofit those end uses in later years. Where a municipality does not wish to require electrification for specific end uses but wants to advance electric buildings further than electric-readiness, exception language can be added. This language specifically calls out regulated loads to be electrified. This allows for certain process loads at commonly owned municipal buildings like wastewater treatment plants, or less commonly owned buildings like airports, be allowed to use non-electric energy sources based on technology availability. Note that buildings like restaurants and hospitals, which are a concern under broader electrification policies for exemption are not likely to be municipally owned.

4) All *new construction* and *major renovation* projects shall procure or export renewable energy that is equal to or greater than all imported grid electricity on an annual basis to achieve zero emissions. *GHG emissions* shall be determined using the following calculation method:

Considering renewable energy sources, both on-site and offsite, and specifying that new construction and major renovations include energy from renewable sources allows municipalities to take the necessary steps to achieve zero emissions.

a. Determine *GHG emissions* from energy consumption in accordance with ASHRAE Standard 105, Section 7.[8] Imported grid electricity and electricity exported from the site shall use the Imported Grid Electricity factors in Table K-3 of Standard 105, Section 7 or locally-derived values.

Calculating the GHG emissions associated with energy consumption and generation will determine how close a building is to achieving its zero emissions goal. ASHRAE Standard 105 provides a nationally recognized standard for the calculation methodology for this accounting.

b. To determine quantities of procured renewable energy, the project shall use the corresponding procurement factors in Table 3 of this section when converting renewable electricity to *GHG emissions.*

8 ASHRAE Standard 105: Standard Methods of Determining, Expressing, And Comparing Building Energy Performance And Green House Gas Emissions. **https://webstore.ansi.org/standards/ashrae/ansiashraestandard1052014**

TABLE 3: ACCEPTABLE RENEWABLE ENERGY SOURCES FOR OFFSETTING GHG EMISSIONS[9]

Source	Procurement Factor	Additional Requirements
On-site renewable energy systems	1.0	Located within the site boundary
Off-site renewable energy system owned by the building project owner	0.75	Where off-site renewable energy facility is owned by governmental agency
Community renewable energy facility	0.75	Generation source must be located within the same utility service area as the building claiming the renewable energy credit
Financial renewable power purchase agreement	0.75	
Physical renewable power purchase agreement	0.75	

i) Off-site renewable energy delivered or credited to the building shall be subject to a legally binding contract to procure qualifying off-site renewable energy. Qualifying off-site renewable energy shall meet the following requirements:

(1) The governmental agency claiming the renewable energy shall sign a legally binding contract to procure qualifying off-site renewable energy with a minimum duration of 20 years. The contract shall be structured to survive a partial or full transfer of ownership of the building property.

(2) The renewable energy generating source shall be photovoltaic systems, solar thermal power plants, geothermal power plants, wind turbines, and fuel cells powered by the renewable energy sources listed here.

(3) The generation source shall be located where the energy can be delivered to the building site by the same utility or distribution entity; the same independent system operator or regional transmission organization; or within integrated independent system operators (electric coordination council).

Many projects do not have space or solar exposure to provide sufficient onsite renewable energy to meet their operational energy or GHG equivalent needs. Offsite procurement options are frequently available to these projects, and the provisions in this section ensure that projects secure binding contracts that guarantee sufficient quality and quantity of procured energy resources.

ii) *RECs* associated with on-site and off-site renewable energy shall comply with all of the following documentation requirements:

(a) Are retained and retired by or on behalf of the property owner or tenant for a period not less than twenty (20) years.

9 Architecture 2030. *ZeroCode™ for California: A California Building Energy Standard for New Nonresidential, High-Rise Residential and Hotel/Motel Buildings.* Page 8, Table 6.3. **https://zero-code.org/wp-content/uploads/2018/09/ZERO-Code-California.pdf**. Note that while this document was developed for California, the procurement factors pulled for this ordinance apply regardless of geography.

(b) Are created within a twelve (12)-month period of the use of the *REC.*

(c) Are from a generating asset constructed no more than five (5) years before the issuance of the certificate of occupancy.

RECs are tradable instruments that represent the environmental attributes of renewable energy, including its renewability and low- or zero-carbon attributes. This section ensures that the RECs associated with renewable energy used for compliance with this policy are not used for another obligation or environmental claim, are of reasonably similar vintage with the building's energy use and encourage new and additional renewable generation.

5) *New construction* and *major renovation* projects with parking facilities for passenger and light duty vehicles shall include *EV* charging infrastructure that meets the following requirements:

   a. All parking spaces designated for overnight parking of government-owned light duty vehicles shall be *EV Ready* or *EVSE* spaces and at least 50% shall be *EVSE* spaces.

   b. No fewer than 50% of parking spaces not designated for government-owned vehicles shall be *EV Capable, EV Ready,* or *EVSE* spaces, and at least 10%, and no fewer than one, shall be *EVSE* spaces.

In some parking lots for guest or visitor parking, it may be feasible to have more than 50% of the spaces be EV Capable, EV Ready, or EVSE spaces. Considerations include the length of time that visitors are expected to park—these requirements are more feasible for spaces where visitors may park for extended periods of time, or for workforce parking.

   c. The requirements for accessible spaces shall be separately calculated and parking at accessible spaces where an *EVSE* is installed shall not be limited to *EVs.*

   d. The building electrical panel that contains the physical space to accommodate the future installation of circuit breakers for *EV Capable* spaces shall have sufficient electrical capacity to provide no less than 1.9 kVA per *EV Capable* space.

As the market for electric vehicles, including light duty vehicles, continues to expand, municipalities will need to accommodate the need for electric vehicle charging now and in the future. The cost of retrofitting parking lots with electric vehicle charging infrastructure (EVCI) is far higher than the cost of installing it as new construction or providing parking spaces with raceways and other low-cost provisions to add EVCI in the future (EV Capable). This proposal includes requirements for EV chargers for some spaces to meet current EV charging needs and requirements for EV capable spaces to provide for cost-effective EV charging retrofits in the future to meet future EV charging needs.

6) All *new construction* and *major renovation* projects shall include materials and products with *GWP* values not exceeding the targets set by state and/or federal government agency, 125% of industry average *GWP* values (based on valid industry-wide *EPDs),* or the "Baseline (high)" *GWP* limits in Carbon Leadership Forum's Material Baseline report.[10] Materials and products covered shall include, aluminum, structural steel (hot rolled, hollow sections, and plate), steel reinforcing bar, ready-mixed concrete, flat glass, insulation products, unit masonry, and wood products.[11] Projects shall calculate and disclose their environmental impact by complying with the reporting requirements of this policy.

   a. Projects may seek an advance written waiver for deviations by material. Waivers will be granted on a material basis, not a project basis.

      i. For any waiver request, the project must state quantities concerned and reasons for not being able to use materials and products that meet the targets identified in Section 7 of this policy.

      ii. All waivers must be preapproved, documented, and the reason for deviation be justified and reported.

      iii. Waivers will be reviewed and granted or denied.

The jurisdiction should consider which agency would be responsible for setting targets and granting waivers under Section 7 above—likely to be a Sustainability Department or similar. That entity should set up an evaluation process for waivers, including identification of reviewers, and criteria for granting waivers. In some cases, this language can be included in the ordinance, and in others, it can be included in agency authority or rulemaking.

   b. All *new construction* and *major renovation* projects shall develop refrigerant management plan, based on California Air Resources Board's (CARB) Refrigerant Management Program (RMP) to address leak detection system, low-GWP refrigerants, and clear roles for refrigerant management.

CARB's RMP requires refrigeration systems containing more than 50 pounds of 150+ GWP refrigerant to conduct and report periodic leak inspections, promptly repair leaks, and keep service records on site. Facilities that use only ammonia or carbon dioxide as refrigerants are not subject to the rule.

Existing Building Requirements

8) Projects that are not classified as *new construction* or *major renovations* shall meet the following requirements:

   a. *Energy retrofit* projects shall install measures and equipment that result in decreased *GHG emissions* from the building relative to the previous measures/equipment.

10 Carbon Leadership Forum. *2021 Carbon Leadership Forum Material Baselines* (July 2021). **https://carbonleadershipforum.org/material-baselines/**

11 List aligns with materials included in H.R.1512 - CLEAN Future Act. 117th Congress. **https://www.congress.gov/bill/117th-congress/house-bill/1512/text**

b. *Energy retrofit* projects shall prioritize measures that result in the replacement of fossil fuel systems and appliances used to meet space conditioning loads and/or provide hot water with high-efficiency all-electric systems and appliances.

c. All fossil fuel systems and appliances used for regulated loads including space conditioning, water heating, cooking, lighting, and all other non-emergency functions shall be replaced with highly efficient all-electric systems and appliances upon the end of useful life.

d. No new fossil fuel systems or appliances for regulated loads including space conditioning, water heating, cooking, lighting or any other non-emergency function shall be installed.

e. Where projects require a building permit, comply with Section 7 of this policy (embodied carbon).

Energy retrofit projects are notoriously difficult to regulate in terms of performance, as they are typically upgrades to equipment and systems (like controls) without comprehensive consideration given to whole building performance. The intention in Section 8 is to think beyond like-for-like equipment replacements and make the necessary changes for building decarbonization. This could also be an opportunity to layer in requirements related to existing pilot programs or demonstration projects within the jurisdiction.

Annual Operational GHG Emissions Reporting

The jurisdiction should make some or all of the reported information public to demonstrate the value of benchmarking and transparency, and demonstrate that zero emissions design and construction is possible within their jurisdiction. In certain cases—such as the issuance of a building permit—this policy may need to be coordinated with reporting requirements locally. As soon as a building is occupied it becomes an existing building, so it will also be important to ensure that newly constructed buildings are designed with any existing building performance standards in mind. New construction requirements should ensure that buildings will comply with—or exceed—building performance standards for the first several compliance cycles.

9) All new construction and major renovation projects larger than **[SIZE THRESHOLD]** completed after the adoption of this policy must disclose the following information to the **[ENFORCING AGENCY]**:

a. Prior to submission of final building permit, the architect or engineer of record shall submit a GHG Emissions Compliance report that includes:

i. Documentation of the applicable energy efficiency requirements:

1. Energy modeling documentation that the *proposed design* has a *site EUI* less than or equal to the *design target;* or

2. The *proposed design* exceeds the most recently published version of ASHRAE 90.1 by 20% or more if a *new construction* project; or

3. The *proposed design* exceeds the most recently published version of ASHRAE 90.1 by 15% or more if a *major renovation* project.

ii. An inventory of all fossil fuel consuming appliances and equipment and confirmation that space conditioning, water heating, cooking, lighting, and all other non-emergency functions are met with all-electric systems and appliances.

Where certain process loads are required based on technology limitations to use fossil fuels, those uses should be fully accounted for to use in understanding the total impact of those systems and to allow for education, research, and coordination with other jurisdictions to understand when and how those uses can transition to electricity or another low carbon fuel source.

iii. An estimate of the annual operational *GHG emissions* associated with the project. The estimate shall be made in accordance with Section 4 of this policy.

iv. A renewable energy assessment that identifies the renewable energy sources that will be used to comply with Section 4 of this policy, and a site plan identifying areas that may be used in the future to provide additional renewable energy.

b. Within two (2) years of final certificate of occupancy, and every year thereafter, the following shall be disclosed:

i. A weather normalized *site EUI* for the previous 12 months.

ii. Documentation that the project has achieved a *GHG emissions* balance of zero where the total calculated emissions associated with the building operation is less than or equal to the emissions avoided as a result of generating or procuring renewable energy over the course of the year.

10) Within five (5) years of the adoption of this policy, and no later than 2030, all governmental agencies shall submit a Fossil Fuel Equipment Elimination plan to the agency or department charged with enforcing this policy that identifies and prioritizes the strategies needed to eliminate fossil fuel combustion within each of their buildings by **[TARGET YEAR]**. This plan shall include:

a. An inventory of each facility's fossil fuel combustion equipment, its install date, and an estimate of the useful life remaining for that equipment;

b. The necessary actions and investments needed to eliminate fossil fuel systems;

c. A timeline for substantial alterations and system replacement efforts;

d. Priority actions for system replacement efforts that have the greatest potential return on investment based on cost analysis that includes the cost of carbon emission impacts;

e. Current electrical capacity; and

f. Site plan showing location of all parking facilities and potential locations for the installation of on-site renewable energy systems.

In addition to new construction, governments have longer term capital plans that dictate the replacement of large, energy-using systems. This provision ensures that the government is incorporating decarbonization strategies into the long-term capital planning process for its entire building portfolio so that as equipment is replaced it is electrified, eliminating on-site fossil fuel combustion.

The measures captured here will allow for planning that can increase economies of scale, for example, buy understanding the number of water heaters that need replaced and their likely end of life, the jurisdiction may be able to complete a bulk purchase or negotiate a better installation contract because of the volume of work. Where buildings or departments are operating in a vacuum, this type of coordination would be unlikely to occur.

Additionally, the plans call for coordination of locations for new on-site renewable energy systems. Where combined with the renewable energy assessments completed by new construction and major renovation projects, a jurisdiction can have a more comprehensive plan for siting future renewable energy production.

Embodied GHG Emissions Reporting

The jurisdiction should consider whether to make some or all of the reported information public to add to a growing body of work and data on embodied carbon reduction strategies. Where data are made public, it is critical that jurisdictions not just publicize the information, but add it to existing databases such as the Federal Life Cycle Assessment (LCA) Commons[12] and Building Transparency.[13]

11) All *new construction* and *major renovation* projects larger than **[SIZE THRESHOLD]** completed after the adoption of this policy must submit *Type III EPD* documentation to the **[ENFORCING AGENCY]** for the materials referenced in Section 7 of this policy at two project milestones:

Type-III EPDs are independently verified and registered documents that report a product's environmental impact over its lifecycle. Absent tracking, reporting and disclosing information through an EPD, it can be difficult to understand the full lifecycle impact of materials, and therefore the full environmental effects of different material selection choices.

a. Within one month of a successful construction bid, the project team must submit documentation of compliance for all eligible materials and applications for material waivers (if applicable).

b. Prior to Certificate of Occupancy, the project team must submit an updated inventory of all eligible materials and products subject to *embodied carbon* thresholds, and approved material waiver(s) (if applicable).

c. Documentation requirements:

   i. Collected *EPDs* for all eligible products and materials indicating compliance

   ii. *Type III EPDs* that meet the following:

      1. A facility-specific manufacturer

      2. Developed according to the guidelines of the applicable Product Category Rule (PCR)[14]

12 Federal LCA Commons. **https://www.lcacommons.gov/**

13 Building Transparency. **https://www.buildingtransparency.org/**

14 ISO 14025:2006 Environmental labels and declarations — Type III environmental declarations — Principles and procedures. **https://www.iso.org/standard/38131.html**

3. Proof of validation as indicated by a date that has not expired at the point of the specification
4. Availability in a publicly accessible database, such as the Embodied Carbon in Construction Calculator (EC3)[15]

A material's CO_2e is represented as GWP and is the most common metric for measuring and evaluating materials' GHG emissions over a product or building's lifecycle. Type III EPDs are appropriate for use in procurement policies because the third-party verified process already exists with agreed-upon resources for calculating and documenting the embodied carbon of products, including the GWP.

12) All *new construction* and *major renovation* projects larger than **[SIZE THRESHOLD]** completed after the adoption of this policy must complete and submit an as-built Life Cycle Assessment in accordance with ISO 14040 series standards.[16]

Embodied carbon disclosure and limits on high impact materials is the first step for jurisdictions. Understanding the full carbon impact of a building through a lifecycle assessment is a needed step to deeper decarbonization. By completing as-built LCAs, jurisdictions can aid in the necessary data gathering needed to create standardized life cycle comparisons and baselines to continue to move research and the industry forward to producing and delivering low-carbon materials.

Requirements for Building Performance

The jurisdiction should consider enforcement mechanisms to ensure that all agencies are required to comply with the policy. This may include transparency requirements to ensure that all are held accountable, or penalties (as local laws allow) for non-compliant agencies. The jurisdiction should also consider resource allocation (technical, staffing, and financial) to ensure that all agencies are positioned to comply with the policy.

13) If the reporting requirements of this policy determine that a *new construction* or *major renovation* building has failed to meet its energy efficiency target within a +5% margin on average over its first three (3) years of operation the asset managing agency of the building must take action(s) to assess and improve its performance by meeting one of the following requirements:
    a. Report actual data for the following measures and recalibrate the original energy model to account for actual operating conditions:
        i. Operating hours and occupancy schedule
        ii. Occupancy load
        iii. Set points

15 Building Transparency. Embodied Carbon in Construction Calculator. **https://www.buildingtransparency.org/**

16 ISO 14040:2006 Environmental management — Life cycle assessment — Principles and framework. **https://www.iso.org/standard/37456.html**

b. Undergo an internal retrocommissioning process targeted at calibration of system set points, controls, and review of operations schedules for mechanical, water heating, lighting and renewable energy systems to target optimal performance.

Jurisdictions looking toward building performance standards should incorporate a verification of design targets into their requirements for their GHG reduction. As buildings become occupied or get reoccupied, it is important to allow some leeway for facility managers to bring their operations towards an expected range. By allowing both a window (three years) and a margin of error, buildings can be reasonably expected to meet these and continue to improve performance. The options presented for correction here are lighter touch, and assume the building is getting close to its optimized operations.

14) If the reporting requirements of this policy determine that a *new construction* or *major renovation* project has failed to meet its energy efficiency target within a 20% margin on average over its first three (3) years of operation, the asset managing agency of the building must take action(s) to assess and improve its performance by meeting one of the following requirements:

a. Undergo a complete retrocommissioning process with a licensed professional that includes an assessment of all mechanical, water heating, lighting, renewable energy, and building control systems and the necessary correction measures to bring the building in line with its stated energy efficiency goals.

Retrocommissioning is a systemic evaluation of a building's energy flows that ensures that systems are efficiently operating and maintained according to the needs of the building occupants. The retrocommissioning might identify physical upgrades (such as insulation, component replacement, or sealing), or operational changes (such as adjusting operating hours) as energy conservation measures to improve the energy efficiency of the building.

b. Conduct an investment-grade energy audit that identifies a suite of energy efficiency measures and management measures for the building, to bring the building in line with its stated zero emissions goals.

The term "investment grade audit" is often used interchangeably with an ASHRAE Level 3 audit. This is a deep analysis of whole-building energy use that includes collection of detailed information over time (including actual building energy use) and the use of that data to calibrate a simulation that explores the impact of changes to the energy-using systems of the building. The findings of this analysis are used to understand and justify the impact of capital-intensive projects for major building systems.

The options presented for correction here are more intensive, and assume the building is not on track to operating under optimized conditions without a more serious intervention.

15) If the reporting requirements of this policy determine that the *GHG emissions* from the project exceed its *GHG emissions* avoided from renewable energy within a +5% margin on an annual basis, the asset managing agency of the building must select and comply with one of the following:

The avoided emissions being referenced above are in reference to Section 4 of this policy, which deals with the procurement or export of renewable energy.

a. Meet the requirements of Item 14a of this policy to reduce the *GHG emissions* associated with building operations to bring the project in line with the emissions avoided from the renewable energy associated with project, on an annual basis.

b. Procure additional renewable energy in order to achieve a *GHG emissions* balance of zero.

Jurisdictions may act to procure or to build additional renewable energy generation based on renewable energy assessment information gathered from its buildings to meet the gap in GHG emissions.

16) Where a building fails to meet either energy or *GHG emissions* targets, the asset managing agency will adopt an implementation plan for the measures identified in Sections 13, 14, and 15 of this policy that may include a phased approach that addresses systems or equipment that do not need to be replaced before end of useful life.

For new construction and major renovations, the expectation should not be for additional major work if the operations are not in line with design. A targeted plan identifying key operations and maintenance strategies for ongoing optimization and opportunities to plan for end-of-life replacements for larger issues will create a system by which the jurisdiction can hold itself accountable without undertaking major renovation costs on new buildings.

Additional Resources:

- American Council for an Energy-Efficient Economy (ACEEE) State and Local Policy Database. **https://database.aceee.org/**
- ASHRAE Standard 90.1: Energy Standard for Buildings Except Low-Rise Residential Buildings. **https://www.ashrae.org/technical-resources/bookstore/standard-90-1**
- ASHRAE Standard 105: Standard Methods Of Determining, Expressing, And Comparing Building Energy Performance And Green House Gas Emissions. **https://webstore.ansi.org/standards/ashrae/ansiashraestandard1052014**
- ASHRAE Standard 189.1: International Green Construction Code®. **https://www.ashrae.org/technical-resources/bookstore/standard-189-1**
- European Standard (EN) 15804+A2: Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products. **https://www.en-standard.eu/csn-en-15804-a2-sustainability-of-construction-works-environmental-product-declarations-core-rules-for-the-product-category-of-construction-products/**
- ISO 14040:2006 Environmental management — Life cycle assessment — Principles and framework. **https://www.iso.org/standard/37456.html**
- ISO 14025:2006: Environmental labels and declarations — Type III environmental declarations — Principles and procedures. **https://www.iso.org/standard/38131.html**
- ISO 21930:2017: Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services. **https://www.iso.org/standard/61694.html**
- New Buildings Institute: Public Buildings Portfolio Management. **https://newbuildings.org/resource/public-buildings-portfolio-management/**
- New Buildings Institute: Zero Energy Commercial Building Targets. **https://newbuildings.org/resource/zero-energy-commercial-building-targets/**
- State of California, Buy Clean California Act: **https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?division=2.&chapter=3.&part=1.&lawCode=PCC&article=5**
- U.S. General Services Administration Requests for Information to Reduce Emissions from Building Materials:
  - » Asphalt: **https://sam.gov/opp/bdff92df33b946569c2147035673d5fb/view**
  - » Concrete: **https://sam.gov/opp/344c2772e6854f0b98e2c1675884d373/view**

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Codes for Climate™

Codes for Climate is an initiative of NBI and RMI to deliver the climate-aligned building codes and standards needed by U.S. states and cities in the face of the pressing demands of policy goals. To scale greenhouse gas reductions in the buildings sector to be in step with a 1.5ºC future, the initiative works to support policy makers at multiple levels to move codes and standards forward, making significant reductions in energy consumption and GHG emissions from buildings possible and effective. The Decarbonization Code supports the goals of the Codes for Climate Initiative. Visit **codesforclimate.org** to learn more.

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New Buildings Institute (NBI) is a nonprofit organization driving better energy performance in buildings to make them better for people and the environment. We work collaboratively with industry market players—governments, utilities, energy efficiency advocates, and building professionals—to promote advanced design practices, innovative technologies, public policies, and programs that improve energy efficiency. The Getting to Zero website houses over 300 curated resources including guidance, educational webinars, policy models, research, case studies, and more to help all buildings achieve zero energy. Visit **gettingtozeroleadership.org** to learn more.